Adolescent Smoking and Exposure to Tobacco Marketing Under a Tobacco Advertising Ban: Findings From 2 Norwegian National Samples

Marc T. Braverman, PhD, and Leif Edvard Aarø, PhD

Objectives. We examined the extent to which adolescents in Norway have been exposed to tobacco marketing despite an existing ban, and whether exposure is related to their current smoking or expectations they will smoke in the future.

Methods. Questionnaires were administered to nationally representative systematic samples of Norwegian youths aged 13 to 15 years in 1990 (n = 4282) and 1995 (n = 4065).

Results. About half in each cohort reported exposure to marketing. Youths reporting exposure were significantly more likely to be current smokers and to expect to be smokers at 20 years of age, after control for important social influence predictors.

Conclusions. Adolescents' current smoking and future smoking expectations are linked to marketing exposure even in limited settings, suggesting the need for comprehensive controls to eliminate the function of marketing in promoting adolescent smoking. (*Am J Public Health.* 2004;94:1230–1238)

The control of tobacco advertising and promotion is a pivotal policy area in the effort to prevent adolescent smoking.[1,2] Nonsmoking adolescents who are aware of cigarette advertising and can identify specific advertisements are more likely to progress toward smoking over time.[3–7] Exposure to tobacco promotional campaigns and ownership of promotional items such as clothing with cigarette brand logos are associated with greater susceptibility to and actual use of tobacco.[3,8–13] As a result of these findings and other evidence linking tobacco marketing activities to youth smoking initiation,[14–18] there has been widespread support among public health advocates for legislated controls on tobacco advertising and promotion.[19–23]

The 1998 Master Settlement Agreement, under which the tobacco industry agreed to restrict the content of print advertisements, eliminate billboard advertising, and limit certain categories of promotional activities, has changed many aspects of tobacco marketing in the United States but has not resolved fundamental concerns about the overall extent of industry marketing activities and their potential impact.[24–27] There are doubts about the effectiveness of the implementation of the Master Settlement Agreement's restrictions[24,25,27] and, more generally, concerns about the success that can be achieved by limiting some but not all forms of tobacco marketing, given the past record of industry resourcefulness in response to legislative restrictions.[28] In fact, overall cigarette marketing expenditures in the United States rose from $4.9 billion in 1995 to $9.5 billion in 2000, with most of the expenditures being used for promotional allowances, special offers, and gifts.[29] Early investigations of the post–Master Settlement Agreement environment have found that advertising also appears to have increased in magazines, especially those with high youth readership,[30–32] and at point-of-sale displays in stores.[32–34]

The policy environment pertaining to controls on tobacco marketing is in significant transition in the rest of the world as well. Numerous countries have instituted partial or comprehensive marketing bans.[29] In late 2002, the 15-nation European Union approved a ban on tobacco advertising through newspapers, magazines, radio, and the Internet, to take effect in 2005.[35] The ban is not comprehensive, since advertising will still be allowed on posters and billboards, in cinema, and through indirect sources such as clothing. This is a critical consideration, because partial bans result in industry resources being shifted to the remaining venues, and thus partial bans have been found to be far less effective than comprehensive bans in reducing tobacco consumption.[36–39] Most significant, in May 2003, the World Health Assembly adopted the Framework Convention on Tobacco Control, an international treaty that will require participating countries to implement, among other provisions, comprehensive bans on tobacco advertising and promotion.[19,40–44] Currently, the process of achieving treaty ratification by the requisite 40 World Health Organization member nations is underway.

At present, there is very little research on the patterns of young people's exposure to tobacco advertising and promotion under conditions of a legislated ban. Relevant studies on US adolescent populations over the past decade have of necessity been conducted under conditions of high saturation of advertising content. For example, surveys from the late 1990s show that virtually all US teenagers have been exposed to some form of tobacco advertising,[1,45,46] and adolescents' advertising exposure worldwide tends to be very high as well.[47] Furthermore, the impact of advertising under restricted conditions is unexplored. If health advocates are successful over the coming years in reducing the exposure of adolescents to advertising and other forms of promotion, new research questions will emerge that pertain to the changing social environment. Research is needed on the degree to which relatively limited exposure to tobacco marketing is associated with young people's tobacco use and with psychosocial variables

that usually predict use. If associations are still found between marketing exposure and smoking behavior, the advisability of relying on partial rather than strong comprehensive bans will be called into question as a tobacco control strategy.

The present study addresses these issues by examining the marketing exposure of adolescents in Norway, as well as the relationship of that exposure to their current smoking and future smoking expectations, using data from 1990 and 1995 national surveys conducted by Norway's National Council on Tobacco and Health (now the Department for Tobacco Control). Norway passed legislation banning the advertising and promotion of tobacco in 1975, which included the advertising of all types of tobacco products as well as the use of tobacco products in connection with advertisements for other types of items. Several exceptions to the prohibition were allowed, including newspapers and other printed materials that were imported into Norway as well as indirect publicity in movies and television broadcasts (e.g., sporting events). Thus, despite the relatively comprehensive nature of the ban, the presence of tobacco marketing was not completely eliminated because of some channels not addressed by the legislation and others that proved difficult to control.[48]

The 1975 Norwegian legislation has been considered a strong success.[48–50,51] For example, smoking rates declined steadily among adolescents and young adults through the 1980s (including a decrease among 13- to 15-year-olds from 45.5% in 1975 to 23.6% in 1990[52]), before leveling off during the 1990s. Nevertheless, one goal of Norway's nationwide survey of adolescents was to gauge the degree of penetration of marketing into the country, despite the ban, from the perspective of its youth. Another was to determine whether the tobacco marketing with which the youth came into contact, though limited, was related to their tobacco use. The ban was strengthened by new legislation in 1996, but its conditions were unchanged for the 1990 and 1995 survey cohorts.

The dependent variables we examine include the adolescents' current smoking status and their expectations about whether they will smoke at 20 years of age. Future expectations to smoke or not smoke is a consistent predictor of transitions pertaining to smoking behavior[4,51,53–55] and adds an important dimension to the understanding of adolescents' cognitions regarding smoking. Altogether, 3 primary questions are investigated: (1) To what degree have Norwegian adolescents been exposed to tobacco marketing, despite the ban? (2) Are adolescents' present smoking habits related to their exposure to marketing? (3) Are adolescents' future smoking expectations related to their exposure to marketing? The examination of these questions can help to shed light on the Norwegian experience as a case study of a nation that has instituted a relatively comprehensive advertising ban.

METHODS

Survey Design and Participants

Participants were Norwegian youths in grades 7 through 9 (13–15 years of age) in 1990 and 1995 who took part in a national tobacco use survey conducted by Norway's National Council on Tobacco and Health. This survey has been administered every 5 years since 1975. The questionnaire consists of two pages with closed-ended items. Items on exposure to tobacco advertising were introduced in 1990. Overall results on tobacco use within this age group, including trends between 1975 and 1995, are described elsewhere.[52]

Prior to implementation, all lower-secondary schools in Norway were sent a letter of invitation from the national Ministry of Education. Participation was obtained from over 90% of the country's schools in each survey year. The questionnaires were completed anonymously by students in their regular classrooms, under the supervision of their classroom teachers.

Sampling procedure. More than 125 000 lower-secondary school students completed the surveys in each survey year. To facilitate data management and analysis, the following sampling procedure was implemented: All students born on the 6th of any month were designated for selection, and their questionnaires were forwarded directly to the National Council for data analysis. Results from the other questionnaires were compiled by school personnel and were not included in this data set. The criterion employed for selecting the sample—a single birth date within each month of the year—was judged to be an unbiased systematic sampling procedure that could be implemented by local school personnel with ease and accuracy, compared with more conventional sampling options. Identification of the 6th was a selection made prior to the first survey and repeated in subsequent survey years.

Thus, the sample in the present analysis constitutes approximately 3.3% (i.e., 12/365 days) of all youths attending lower-secondary school in Norway and responding to the survey. There were 4310 respondents in 1990 and 4122 in 1995. According to nationwide school enrollment figures for those years, the estimated survey participation rate for all students in grades 7 through 9 was 80.8% in 1990 and 80.1% in 1995.

Measures

Information was collected on gender; grade; lifetime smoking prevalence; and smoking by mother, father, closest friend, and older siblings (if applicable). The dependent variables in the logistic regressions were current smoking status (daily, occasionally, or never) and future smoking expectations, which was assessed with the question (in translation): "Do you think you will be smoking daily when you are about 20 years old?" (definitely yes, probably yes, probably no, or definitely no).

The independent variable in the regressions was exposure to marketing. Students were asked: "In Norway, all tobacco advertising is forbidden. Despite this, have you recently seen anything that appeared to you to be an ad for cigarettes or other tobacco products?" (yes, no, or don't know). Youths answering "yes" were directed to a checklist of 10 potential venues or locations for tobacco marketing: cinema, television, cafes or restaurants, shops, clothing, ashtrays or matchboxes, toys, carrying bags, magazines or newspapers, and other sources. Youths identified those places where they had seen the marketing. A 4-level count variable was created that reflected the total of locations identified (no locations, 1–2 locations, 3–4 locations, or 5 or more locations).

Procedure

Schools received a packet from the National Council that included instructions to the school administrator and classroom teachers, survey questionnaires for all students, and a school-level reporting form. Teachers administered the survey on a designated day in the fall of the year and, if possible, at the same time in all classes. The questionnaire required about 15 minutes to complete. Students were instructed not to write their names on the questionnaires.

Prior to survey administration, teachers were given a list of students in their class who were born on the 6th day of any month. After the survey had been completed, those students were directed by their teacher to seal their questionnaires in individual envelopes, which were subsequently sent to the National Council for analysis. Thus, during data collection, the experiences of the students in the national sample were identical to those of their classmates. Results from the remaining questionnaires were compiled and used locally by school personnel.

Data Analyses

Data preparation. Prior to data analysis, cases missing information on current smoking status were eliminated from the data set. In addition, cases were identified in which the respondent provided inconsistent information (e.g., reported never having tried smoking but also reported being a daily or occasional smoker). There were only 23 such cases in 1990 and 45 in 1995, and they were eliminated from further analysis. This resulted in a final sample of 4282 youths in 1990 and 4065 youths in 1995.

Summary data and bivariate relationships. For each survey year, data were analyzed to determine the overall level of reported exposure to marketing. Chi-square analyses were used to test the statistical associations between youths' current smoking status and their reported exposure to each marketing venue.

Logistic regressions. To determine whether marketing exposure had an association with current smoking that could be statistically isolated from other potential correlates, we created a dichotomous variable for respondents' current smoking (1=daily or occasional use; 0=no use) and conducted logistic regressions for each survey year, with the 4-level exposure variable as the independent variable of interest. Gender, grade, parental smoking (combined into 1 three-level variable), best friend smoking, and older sibling smoking were included in the model as statistical controls.

We also used logistic regression to examine the relationship between marketing exposure and future expectations to smoke. The 4-level future expectations measure was collapsed into a dichotomous variable (expects vs does not expect to smoke) for use as a dependent variable. The predictor of most interest was the marketing exposure variable. Gender, grade, current smoking status, parental smoking, best friend smoking, and older sibling smoking were included as controls. Once again, separate analyses were conducted for the 2 cohorts.

RESULTS

Descriptive Information and Bivariate Relationships

Table 1 presents descriptive information on the 2 samples and the variables in the analysis. In both 1990 and 1995, slightly more than half the Norwegian youths had tried smoking and about 1 in 4 smoked daily or occasionally. There was an increase in occasional smoking between 1990 and 1995, from 14.5% of the total sample to 17.5%. As the χ^2 analyses show, smoking was significantly more prevalent among girls and older youths, and was strongly associated with parental smoking, sibling smoking, and best friend smoking. Future smoking expectations were similar across the 2 cohorts: in each year, about 11% responded that they expected to smoke (definitely or probably), whereas about 44% believed that they definitely would not. There was a decrease in the percentage of pupils who reported having seen tobacco marketing (from 55.7% to 49.1%). Finally, the bivariate relationships between smoking and exposure to marketing were highly significant in both years. Youths who reported seeing marketing were much more likely to be current smokers than those who did not.

Tobacco Marketing Venues

Table 2 presents the venues in which the youths reported viewing marketing. Overall self-reported exposure is displayed for each venue along with the relationship of that exposure to respondents' smoking status. The widest exposure was reported for tobacco paraphernalia (ashtrays, matchboxes, and lighters), cited by 33.5% of 1990 respondents and 29.3% of 1995 respondents. Not surprisingly, the exposure to these smoking accessories was strongly associated with smoking status, with smokers' exposure being particularly high. However, it is noteworthy that even among nonsmokers these paraphernalia constituted the most widely reported category, with 29.0% (n=947) of nonsmokers in 1990 and 25.0% (n=753) in 1995 reporting exposure. This was followed by the venues of carrying bags; shops and kiosks; clothing; and cafes, snack bars, and restaurants. The venues more closely aligned with mass media—cinema, TV, and magazines—were marked by considerably less exposure in both years.

As the χ^2 analyses demonstrate, smoking status was strongly related to reported exposure within each venue. Almost all the χ^2 tests revealed highly significant associations; only TV, toys, and other places, all in 1990, were nonsignificant.

Logistic Regressions

Table 3 presents the adjusted odds ratios (with 95% confidence intervals) and *P* values resulting from the logistic regressions on smoking status. The analyses show that with the effects of the other social influence variables controlled, smoking status was highly significantly predicted by reported marketing exposure, even for youths who reported only 1 or 2 locations. In both years, the adjusted odds ratios were greater than 2 for those youths who reported 5 or more locations. All of the predictor variables were highly significant, and there was striking consistency across the 2 cohorts. There was only one case where the two years were different: the intermediate level of parental smoking (1 parent smokes) was significant in 1995 but not in 1990.

Table 4 presents the logistic regressions on the youths' future expectations of smoking at

TABLE 1—Characteristics of 1990 and 1995 Samples

Variable	1990 n (%)	1990 % in Demographic Category: Daily Smoker (n = 392)	1990 % in Demographic Category: Occasional Smoker (n = 623)	1990 % in Demographic Category: Nonsmoker (n = 3267)	1995 n (%)	1995 % in Demographic Category: Daily Smoker (n = 334)	1995 % in Demographic Category: Occasional Smoker (n = 713)	1995 % in Demographic Category: Nonsmoker (n = 3018)
Total sample	4282 (100%)	9.2	14.5	76.3	4065 (100%)	8.2	17.5	74.2
Gender[a]								
Male	2221 (51.9%)	8.7	12.8	78.5	2090 (51.5%)	7.5	15.2	77.3
Female	2060 (48.1%)	9.7	16.4	73.9	1969 (48.5%)	9.0	19.9	71.1
χ^2_2		13.69				20.65		
P		.001				<.001		
Grade								
7th	1403 (32.8%)	1.9	9.1	89.1	1347 (33.1%)	2.4	11.7	85.8
8th	1425 (33.3%)	7.2	16.0	76.8	1343 (33.0%)	7.4	18.4	74.2
9th	1453 (33.9%)	18.1	18.4	63.5	1374 (33.8%)	14.6	22.4	63.0
χ^2_4		323.34				217.77		
P		<.001				<.001		
Father smokes								
Yes	1947 (45.8%)	12.7	15.9	71.4	1639 (40.9%)	11.2	19.3	69.4
No	2304 (54.2%)	6.1	13.4	80.5	2373 (59.1%)	6.0	16.2	77.8
χ^2_2		66.08				46.81		
P		<.001				<.001		
Mother smokes								
Yes	1937 (45.4%)	12.4	16.0	71.6	1647 (40.6%)	12.8	19.8	67.5
No	2333 (54.6%)	6.4	13.4	80.2	2412 (59.4%)	5.1	15.9	78.9
χ^2_2		57.24				94.64		
P		<.001				<.001		
Older sibling smokes								
Yes	980 (22.9%)	20.1	21.1	58.8	888 (21.9%)	16.3	23.3	60.4
No	1808 (42.3%)	5.1	13.0	81.9	1733 (42.8%)	5.9	15.5	78.6
No older sibling	1484 (34.7%)	6.8	12.1	81.1	1432 (35.3%)	6.1	16.2	77.7
χ^2_4		258.78				142.51		
P		<.001				<.001		
Best friend smokes								
Yes	893 (20.9%)	37.0	32.0	31.0	959 (23.8%)	31.0	36.6	32.4
No	3370 (79.1%)	1.7	9.9	88.4	3066 (76.2%)	1.0	11.6	87.4
χ^2_2		1506.81				1358.04		
P		<.001				<.001		
Tried smoking								
Yes	2422 (56.6%)	16.2	25.7	58.1	2299 (56.6%)	14.5	31.0	54.5
No	1855 (43.4%)	0.0	0.0	100.0	1760 (43.4%)	0.0	0.0	100.0
χ^2_2		1019.27				1080.15		
P		<.001				<.001		
Expects to smoke at 20 years of age								
Definitely yes	46 (1.1%)	69.6	23.9	6.5	82 (2.0%)	76.8	17.1	6.1
Probably yes	440 (10.3%)	57.0	25.0	18.0	352 (8.7%)	47.4	31.8	20.7
Probably no	1964 (46.0%)	4.9	21.2	73.8	1808 (44.8%)	4.8	24.6	70.6
Definitely no	1824 (42.7%)	0.5	4.7	94.8	1793 (44.4%)	0.8	7.7	91.5
χ^2_6		2003.48				1730.19		
P		<.001				<.001		
Has seen tobacco marketing								
Yes	2383 (55.7%)	11.8	17.2	71.0	1997 (49.1%)	11.4	21.1	67.6
No	1899 (44.3%)	5.8	11.3	82.9	2068 (50.9%)	5.2	14.1	80.7
χ^2_2		85.48				99.17		
P		<.001				<.001		

[a]Sums differ slightly because of missing data on demographic variables.

TABLE 2—Locations of Exposure to Tobacco Marketing

Location	1990 (n = 4282) n (%)	1990 % in Location Category: Daily Smoker (n = 392)	Occasional Smoker (n = 1623)	Nonsmoker (n = 3267)	1995 (n = 4065) n (%)	1995 % in Location Category: Daily Smoker (n = 334)	Occasional Smoker (n = 713)	Nonsmoker (n = 3018)
At the cinema								
Yes	425 (9.9%)	11.5	18.6	69.9	264 (6.5%)	14.0	23.1	62.9
No	3856 (90.1%)	8.9	14.1	77.0	3801 (93.5%)	7.8	17.2	75.0
χ^2_2		10.81				21.45		
P		.004				<.001		
On television								
Yes	623 (14.5%)	10.4	15.7	73.8	427 (10.5%)	13.3	18.5	68.1
No	3659 (85.5%)	8.9	14.3	76.7	3638 (89.5%)	7.6	17.4	75.0
χ^2_2		2.58				17.93		
P		NS				<.001		
At a cafe, snack bar, or restaurant								
Yes	585 (13.7%)	13.5	18.8	67.7	574 (14.1%)	13.4	24.2	62.4
No	3697 (86.3%)	8.5	13.9	77.7	3491 (85.9%)	7.4	16.4	76.2
χ^2_2		29.01				51.66		
P		<.001				<.001		
In shops or kiosks								
Yes	777 (18.1%)	13.9	18.8	67.3	591 (14.5%)	16.4	22.5	61.1
No	3505 (81.9%)	8.1	13.6	78.3	3474 (85.5%)	6.8	16.7	76.5
χ^2_2		45.13				82.39		
P		<.001				<.001		
On clothing								
Yes	722 (16.9%)	13.2	19.8	67.0	626 (15.4%)	12.1	24.0	63.9
No	3560 (83.1%)	8.3	13.5	78.2	3439 (84.6%)	7.5	16.4	76.1
χ^2_2		41.46				41.93		
P		<.001				<.001		
On ashtrays, matchboxes, or cigarette lighters								
Yes	1436 (33.5%)	15.0	19.0	65.9	1190 (29.3%)	13.9	22.8	63.3
No	2846 (66.5%)	6.2	12.3	81.5	2875 (70.7%)	5.8	15.4	78.8
χ^2_2		141.69				120.83		
P		<.001				<.001		
On toys								
Yes	94 (2.2%)	8.5	14.9	76.6	54 (1.3%)	27.8	22.2	50.0
No	4188 (97.8%)	9.2	14.5	76.3	4011 (98.7%)	8.0	17.5	74.6
χ^2_2		.05				30.50		
P		NS				<.001		
On carrying bags								
Yes	902 (21.1%)	13.1	17.7	69.2	823 (20.2%)	11.7	22.2	66.1
No	3380 (78.9%)	8.1	13.7	78.2	3242 (79.8%)	7.3	16.3	76.3
χ^2_2		34.83				37.12		
P		<.001				<.001		
In Norwegian magazines or newspapers								
Yes	414 (9.7%)	10.1	21.3	68.6	318 (7.8%)	13.8	23.3	62.9
No	3868 (90.3%)	9.0	13.8	77.1	3747 (92.2%)	7.7	17.1	75.2
χ^2_2		18.22				25.71		
P		<.001				<.001		
Other places								
Yes	332 (7.8%)	9.9	16.9	73.2	373 (9.2%)	11.5	20.4	68.1
No	3950 (92.2%)	9.1	14.4	76.6	3692 (90.8%)	7.9	17.3	74.9
χ^2_2		2.03				9.45		
P		NS				.009		

Note. NS = not significant.

TABLE 3—Logistic Regression Predicting Adolescents' Current Smoking

Variable	1990 n	1990 OR (95% CI)	1990 P	1995 n	1995 OR (95% CI)	1995 P
Gender						
Male	2184	1.00 ...		2059	1.00 ...	
Female	2027	1.32 (1.10, 1.58)	.002	1931	1.43 (1.20, 1.71)	<.001
Grade						
7th	1381	1.00 ...		1317	1.00 ...	
8th	1402	2.10 (1.65, 2.68)	<.001	1319	1.79 (1.42, 2.26)	<.001
9th	1428	3.29 (2.60, 4.16)	<.001	1354	2.81 (2.24, 3.51)	<.001
Parental smoking						
Neither parent smokes	1608	1.00 ...		1707	1.00 ...	
1 parent smokes	1386	1.21 (0.97, 1.50)	NS	1336	1.38 (1.13, 1.70)	.002
Both parents smoke	1217	1.37 (1.09, 1.70)	.006	947	1.63 (1.31, 2.04)	<.001
Best friend smoking						
No	3335	1.00 ...		3042	1.00 ...	
Yes	876	12.63 (10.46, 15.24)	<.001	948	10.83 (9.05, 12.97)	<.001
Older sibling smoking						
No	1778	1.00 ...		1716	1.00 ...	
Yes	967	2.36 (1.90, 2.93)	<.001	868	1.76 (1.42, 2.19)	<.001
No older sibling	1466	1.08 (0.87, 1.34)	NS	1406	1.01 (0.83, 1.24)	NS
Marketing exposure						
No locations	1866	1.00 ...		2029	1.00 ...	
1–2 locations	1285	1.80 (1.46, 2.23)	<.001	1113	1.44 (1.17, 1.78)	.001
3–4 locations	738	1.87 (1.46, 2.38)	<.001	583	1.96 (1.53, 2.50)	<.001
≥5 locations	322	2.12 (1.53, 2.95)	<.001	265	2.25 (1.62, 3.14)	<.001

Note. OR = odds ratio; CI = confidence interval; NS = not significant. N = 4211 in 1990; N = 3990 in 1995. Dependent variable coding: 0 = current nonsmoker; 1 = daily or occasional smoker.

20 years of age. The analyses show, once again, that marketing exposure has a highly significant effect on this variable, even when effects of the other correlates have been controlled—although in this case, the effect was significant only when 3 or more locations were reported. The highest exposure level—5 or more locations—once again was associated with adjusted odds ratios greater than 2. As in the current smoking analyses, the patterns for 1990 and 1995 were very consistent on almost all predictors.

DISCUSSION

These results indicate that even in the context of a relatively comprehensive ban, about half of Norway's adolescents reported exposure to marketing. Although this level of exposure is far less than levels in other countries, according to 1999–2001 data from the Global Youth Tobacco Survey,[47] it must nevertheless be considered a high proportion in light of the legislation's intent, and reflects the challenges faced by individual nations that attempt to eliminate marketing in its numerous forms.

In addition, the findings establish that adolescents' current smoking status and their expectations about smoking in early adulthood can be linked to marketing exposure even in a context where most forms of advertising are banned and exposure is much lower than will be found in the great majority of countries. In both cohorts, youths who reported seeing marketing in 5 or more types of locations were roughly twice as likely to be current smokers and to expect to smoke at 20 years of age. Furthermore, their current smoking status was significantly associated with even the lowest level of exposure (only 1–2 locations). The results for 1990 and 1995 were highly comparable, and thus these samples provide independent replications for the analyses and serve as evidence for the stability of the relationships.

Interpreting the Findings

The logistic regressions controlled for social influence variables that are powerful and consistent predictors of adolescent smoking. To the extent that marketing exposure might be correlated with these social influence factors, our model probably represents a conservative test of marketing's contribution to predicting the 2 dependent variables. For example, since one effect of tobacco advertising is to increase favorable images of smoking within peer networks,[56] the predictive power of friends' tobacco use may reflect, in part, one effect of advertising. Thus, inclusion of best friend smoking as a control in the regression model masks some of advertising's indirect effect and may result in an underestimation of its overall relationship to smoking.

It is noteworthy that marketing exposure was found to be predictive of future smoking expectations even when controlling for the respondents' own current smoking, which was, not surprisingly, an extremely powerful predictor of future expectations. This suggests that the adolescents were responding on the basis of an active self-definition process that went beyond a straightforward assumption that they would continue their present behavior patterns into the future. For example, more than one fourth of daily smokers (27.5% in 1990 and 30.5% in 1995) and the great majority of occasional smokers (80.5% in 1990 and 82.2% in 1995) believed they would not be smoking at 20 years of age, although a small proportion of current nonsmokers (2.5% in 1990 and 2.6% in 1995) believed that they would. Our results indicate that marketing exposure may contribute to the variability in this self-definition process. Investigations of the intraindividual factors that affect the accuracy of young people's expectations are clearly warranted.

Although these links are strong, the data do not demonstrate that a causal relationship exists between marketing exposure and either current smoking status or future expectations.

TABLE 4—Logistic Regression Predicting Adolescents' Future Smoking Expectations

Variable	1990 n	1990 OR (95% CI)	1990 P	1995 n	1995 OR (95% CI)	1995 P
Gender						
Male	2180	1.00 ...		2045	1.00 ...	
Female	2025	1.53 (1.17, 1.99)	.002	1916	0.82 (0.63, 1.07)	NS
Grade						
7th	1379	1.00 ...		1303	1.00 ...	
8th	1400	0.65 (0.46, 0.92)	.014	1310	0.51 (0.36, 0.72)	<.001
9th	1426	0.48 (0.34, 0.69)	<.001	1348	0.35 (0.25, 0.50)	<.001
Current smoking						
Never	3215	1.00 ...		2949	1.00 ...	
Occasionally	609	7.08 (5.02, 10.00)	<.001	687	6.32 (4.50, 8.87)	<.001
Daily	381	82.50 (53.48, 127.28)	<.001	325	59.43 (38.63, 91.41)	<.001
Parental smoking						
Neither parent smokes	1607	1.00 ...		1700	1.00 ...	
1 parent smokes	1384	2.78 (1.94, 3.98)	<.001	1320	1.98 (1.41, 2.77)	<.001
Both parents smoke	1214	4.26 (3.00, 6.06)	<.001	941	2.81 (2.01, 3.94)	<.001
Best friend smoking						
No	3330	1.00 ...		3020	1.00 ...	
Yes	875	1.49 (1.09, 2.04)	.013	941	1.94 (1.41, 2.65)	<.001
Older sibling smoking						
No	1776	1.00 ...		1701	1.00 ...	
Yes	967	1.62 (1.18, 2.21)	.003	859	1.57 (1.15, 2.14)	.004
No older sibling	1462	0.96 (0.69, 1.34)	NS	1401	0.82 (0.59, 1.14)	NS
Marketing exposure						
No locations	1864	1.00 ...		2010	1.00 ...	
1–2 locations	1284	1.31 (0.95, 1.81)	NS	1107	1.01 (0.72, 1.40)	NS
3–4 locations	736	1.45 (1.01, 2.06)	.043	579	1.85 (1.30, 2.63)	.001
≥5 locations	321	2.42 (1.56, 3.76)	<.001	265	2.08 (1.33, 3.23)	.001

Note. OR = odds ratio; CI = confidence interval; NS = not significant. N = 4205 in 1990; N = 3961 in 1995. Dependent variable coding: 0 = expects not to smoke; 1 = expects to smoke.

In addition to differences in actual exposure to marketing, respondents' reports on these variables might reflect differences in selective attention, perception, interpretation, and memory for tobacco marketing,[57,58] and smoking susceptibility might precede differences in these underlying cognitive processes. Thus, youths who are at higher risk for starting smoking—and who predict they will smoke in adulthood—might attend more closely to tobacco advertisements or be more likely to remember them. Nevertheless, even the mechanisms that do not imply a direct causal link provide serious cause for concern. Tobacco advertising and promotion can serve to reassure adolescents and reinforce their developing notions about the extent of smoking in society, its acceptability, its social value, and its relationship to their own identities.[1,59–61] Advertising has also been found to reduce adolescents' perceptions of the risks associated with smoking.[56] These normative and attitudinal processes can occur for adolescents at any phase of progression, including neversmokers, experimenters, and experienced smokers. Therefore, even if differences in reported exposure are the result of selective attention by youths who are already favorable toward smoking, such exposure can increase the likelihood of future experimentation or regular smoking or can decrease the likelihood of quitting.

Finally, the analysis did not include psychosocial variables such as perceptions of smoking prevalence or perceptions of the social benefits of smoking, many of which are strongly implicated in tobacco initiation.[2,51] It is likely that marketing exposure interacts with these variables through a variety of mediating mechanisms to influence smoking susceptibility, and the exploration of these relationships is another important avenue for further research.

Implications for Policy

What can be learned from these findings relating to advertising bans? These data demonstrate that there can be significant marketing penetration despite a ban, and that the relationship between marketing and youth smoking persists even in this specialized context of limited exposure. Our finding that most of the frequently cited marketing venues involved promotional items—ashtrays, clothing, and carrying bags—rather than mass communication media suggests that the industry's use of promotional activities presents a particular challenge for legislative efforts to restrict tobacco marketing. The response must be stricter enforcement of existing laws, the introduction of broader legislation, and international cooperation to reduce tobacco advertising and the distribution of tobacco promotional items. Norway has continued its tradition of strong legislative activity in all areas of tobacco control—including a smoking ban in all restaurants and bars that took effect in June 2004—and now has a fully comprehensive ban on all forms of tobacco advertising, promotion, and sponsorship.

In the United States, the combined effects of local ordinances and legal settlements are resulting in wider constraints on tobacco advertising and promotion. In past years, the exposure of youths to marketing has been nearly universal,[1,45,46] but this situation may change over the coming years. Although more research is needed, the present results suggest that even very limited levels of advertising and promotion are cause for concern. Thus, the Norwegian experience can serve as a model that other countries can use to examine the interaction patterns of smoking risk factors under highly constrained marketing conditions. ■

About the Authors

Marc T. Braverman is with the University of California, Davis. Leif Edvard Aarø is with the University of Bergen in Norway.

Requests for reprints should be sent to Marc T. Braverman, PhD, Department of Human and Community Development, University of California, One Shields Avenue, Davis, CA 95616 (email: mtbraverman@ucdavis.edu).

This article was accepted April 21, 2003.

Contributors

Both authors developed the research questions, designed the data analyses, and interpreted the results. M.T. Braverman conducted the data analyses and drafted the article. L.E. Aarø was an investigator on the original survey project, participated in designing the survey and data collection procedures, participated in the data analyses, and reviewed and revised the article.

Acknowledgments

The first author (M.T. Braverman) conducted part of the work for this article while on sabbatical leave as a visiting researcher at Norway's National Institute of Public Health, Unit for Disease Prevention and Health Promotion (now part of the Norwegian Institute of Public Health). He gratefully acknowledges their generous support.

We thank the Norwegian Directorate for Health and Social Affairs, Department for Tobacco Control (previously the National Council on Tobacco and Health) for making the databases available for analysis and, in particular, to Rita Lindbak for expert consultation and support.

Human Participant Protection

The survey design and data collection were approved by Norway's Ministry of Education and conducted under the auspices of the Ministry of Education and Norway's National Council on Tobacco and Health (now the Department for Tobacco Control). Both are national government agencies.

References

1. Biener L, Siegel MB. The role of tobacco advertising and promotion in smoking initiation. In: *Changing Adolescent Smoking Prevalence: Smoking and Tobacco Control.* Monograph 14. Bethesda, Md: US Dept of Health and Human Services, National Institutes of Health, National Cancer Institute; 2001. NIH publication 02-5086.

2. Lynch BS, Bonnie RJ, eds. *Growing Up Tobacco Free: Preventing Nicotine Addiction in Children and Youths.* Washington, DC: National Academy Press, Institute of Medicine; 1994.

3. Pierce JP, Choi WS, Gilpin EA, Farkas AJ, Berry CC. Tobacco industry promotion of cigarettes and adolescent smoking. *JAMA.* 1998;279:511–515.

4. Aitken PP, Eadie DR, Hastings GB, Haywood AJ. Predisposing effects of cigarette advertising on children's intentions to smoke when older. *Br J Addict.* 1991;86:383–390.

5. While D, Kelly S, Huang W, Charlton A. Cigarette advertising and onset of smoking in children: questionnaire survey. *BMJ.* 1996;313:398–399.

6. Choi WS, Ahluwalia JS, Harris KJ, Okuyemi K. Progression to established smoking: the influence of tobacco marketing. *Am J Prevent Med.* 2002;22: 228–233.

7. Unger JB, Johnson CA, Rohrbach LA. Recognition and liking of tobacco and alcohol advertisements among adolescents: relationships with susceptibility to substance use. *Prevent Med.* 1995;24:461–466.

8. Altman DG, Levine DW, Coeytaux R, Slade J, Jaffe R. Tobacco promotion and susceptibility to tobacco use among adolescents aged 12 through 17 years in a nationally representative sample. *Am J Public Health.* 1996;86:1590–1593.

9. Evans N, Farkas A, Gilpin E, Berry C, Pierce JP. Influence of tobacco marketing and exposure to smokers on adolescent susceptibility to smoking. *J Natl Cancer Inst.* 1995;87:1538–1545.

10. Lee H, Buller D, Chassin L, Kronenfeld J, MacKinnon D. Influence of cigarette promotion on mediators of smoking. In: Lu R, Mackay J, Niu S, Peto R, eds. *Tobacco: The Growing Epidemic. Proceedings of the Tenth World Conference on Tobacco or Health, 24–28 August 1997, Beijing, China.* London: Springer-Verlag; 2000: 353–357.

11. Sargent JK, Dalton M, Beach M. Exposure to cigarette promotions and smoking uptake in adolescents: evidence of a dose-response relation. *Tob Control.* 2000;9:163–168.

12. Schooler C, Feighery E, Flora JA. Seventh graders' self-reported exposure to cigarette marketing and its relationship to their smoking behavior. *Am J Public Health.* 1996;86:1216–1221.

13. Biener L, Siegel M. Tobacco marketing and adolescent smoking: more support for a causal inference. *Am J Public Health.* 2000;90:407–411.

14. King C, Siegel M, Celebucki C, Connolly GN. Adolescent exposure to cigarette advertising in magazines: an evaluation of brand-specific advertising in relation to youth readership. *JAMA.* 1998;279:516–520.

15. Pucci LG, Siegel M. Features of sales promotion in cigarette magazine advertisements, 1980–1993: an analysis of youth exposure in the United States. *Tob Control.* 1999;8:29–36.

16. Arnett JJ, Terhanian G. Adolescents' responses to cigarette advertisements: links between exposure, liking, and the appeal of smoking. *Tob Control.* 1998;7: 129–133.

17. Pierce JP, Gilpin EA, Choi WS. Sharing the blame: smoking experimentation and future smoking-attributable mortality due to Joe Camel and Marlboro advertising and promotions. *Tob Control.* 1999;8:37–44.

18. Arnett JJ. Adolescents' responses to cigarette advertisements for five "youth brands" and one "adult brand." *J Res Adolesc.* 2001;11:425–443.

19. Brundtland GH. Achieving worldwide tobacco control. *JAMA.* 2000;284:750–751.

20. *Reducing Tobacco Use: A Report of the Surgeon General–Executive Summary.* Atlanta, Ga: US Dept of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2000.

21. *The World Health Report 2002: Reducing Risks, Promoting Healthy Life.* Geneva, Switzerland: World Health Organization; 2002.

22. *Guidelines for Controlling and Monitoring the Tobacco Epidemic.* Geneva, Switzerland: World Health Organization; 1998.

23. Lu R, Mackay J, Niu S, Peto R, eds. *Tobacco: The Growing Epidemic. Proceedings of the Tenth World Conference on Tobacco or Health, 24–28 August 1997, Beijing, China.* London: Springer-Verlag; 2000.

24. Daynard RA, Parmet W, Kelder G, Davidson P. Implications for tobacco control of the multistate tobacco agreement. *Am J Public Health.* 2001;91: 1967–1971.

25. Houston T, Kaufman NJ. Tobacco control in the 21st century: searching for answers in a sea of change. *JAMA.* 2000;284:752–753.

26. Siegel M. Counteracting tobacco motor sports sponsorship as a promotional tool: is the tobacco settlement enough? *Am J Public Health.* 2001;91: 1100–1106.

27. Feighery E, Ribisl KM, Schleicher N, Lee RE, Halvorson S. Cigarette advertising and promotional strategies in retail outlets: results of a statewide survey in California. *Tob Control.* 2001;10:184–188.

28. Altman DG, Jackson C. Adolescent tobacco use and the social context. In: Shumaker SA, Schron EB, Ockene JK, McBee WL, eds. *The Handbook of Health Behavior Change.* 2nd ed. New York: Springer; 1998: 305–329.

29. Mackay J, Eriksen M. *The Tobacco Atlas.* Geneva, Switzerland: World Health Organization; 2002.

30. King C, Siegel M. The Master Settlement Agreement with the tobacco industry and cigarette advertising in magazines. *N Engl J Med.* 2001;345:504–511.

31. Hamilton WL, Turner-Bowker DM, Celebucki CC, Connolly GN. Cigarette advertising in magazines: the tobacco industry response to the Master Settlement Agreement and to public pressure. *Tob Control.* 2002; 11:ii54–ii58.

32. Gilpin EA, Emery SL, Farkas AJ, Distefan JM, White MM, Pierce JP. *The California Tobacco Control Program: A Decade of Progress, Results from the California Tobacco Surveys, 1990–1999.* La Jolla, Calif: University of California, San Diego; 2001.

33. Celebucki CC, Diskin K. A longitudinal study of externally visible cigarette advertising on retail storefronts in Massachusetts before and after the Master Settlement Agreement. *Tob Control.* 2002;11:ii47–ii53.

34. Wakefield MA, Terry-McElrath YM, Chaloupka FJ, et al. Tobacco industry marketing at point of purchase after the 1998 MSA billboard advertising ban. *Am J Public Health.* 2002;92:937–940.

35. Meller P. Europe outlaws tobacco ads in magazines and newspapers. *New York Times.* December 3, 2002;sect A:12.

36. Saffer H. Tobacco advertising and promotion. In: Hja P, Chaloupka F, eds. *Tobacco Control in Developing Countries.* Oxford: Oxford University Press; 2000: 215–236.

37. Saffer H, Chaloupka F. The effect of tobacco advertising bans on tobacco consumption. *J Health Econ.* 2000;19:1117–1137.

38. Lantz PM, Jacobson PD, Warner KE, et al. Investing in youth tobacco control: a review of smoking prevention and control strategies. *Tob Control.* 2000;9: 47–63.

39. *Curbing the Epidemic: Governments and the Eco-*

nomics of Tobacco Control. Washington, DC: World Bank; 1999.

40. Bettcher D, Subramaniam C. The necessity of global tobacco regulations. *JAMA.* 2001;286:2737.

41. Myers ML, Wilkenfeld JP. The worldwide tobacco treaty. *JAMA.* 2001;286:2736.

42. Satcher D. Why we need an international agreement on tobacco control. *Am J Public Health.* 2001;91:191–193.

43. World Health Organization. The Framework Convention on Tobacco Control. Available at: http://www.who.int/tobacco/fctc/en/. Accessed July 16, 2003.

44. Collin J, Gilmore AB. Tobacco control, the European Union and WHO. *Eur J Public Health.* 2002;12:242–243.

45. Independent Evaluation Consortium. *Final Report of the Independent Evaluation of the California Tobacco Control Prevention and Education Program: Wave 1 Data, 1996–1997.* Rockville, Md: The Gallup Organization; 1998.

46. Soldz S, Kreiner P, Clark TW, Krakow M. Tobacco use among Massachusetts youth: is tobacco control working? *Prev Med.* 2000;31:287–295.

47. Global Youth Tobacco Survey Collaborative Group. Tobacco use among youth: a cross country comparison. *Tob Control.* 2002;11:252–270.

48. Rimpelä MK, Aarø LE, Rimpelä AH. The effects of tobacco sales promotion on initiation of smoking: experiences from Finland and Norway. *Scand J Soc Med.* 1993;49(suppl):5–23.

49. Kraft P, Svendsen T. Tobacco use among young adults in Norway, 1973–95: has the decrease levelled out? *Tob Control.* 1997;6:27–32.

50. Bjartveit K, Lund KE. *The Norwegian Ban on Advertising of Tobacco Products: Has It Worked?* Oslo, Norway: The Norwegian Cancer Society; 1998.

51. *Preventing Tobacco Use Among Young People: A Report of the Surgeon General.* Atlanta, Ga: US Dept of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 1994.

52. Braverman MT, Svendsen T, Lund KE, Aarø LE. Tobacco use by early adolescents in Norway. *Eur J Public Health.* 2001;11:218–224.

53. Pierce JP, Choi WS, Gilpin EA, Farkas AJ, Merritt RK. Validation of susceptibility as a predictor of which adolescents take up smoking in the United States. *Health Psychol.* 1996;15:355–361.

54. Choi WS, Pierce JP, Gilpin EA, Farkas AJ, Berry CC. Which adolescent experimenters progress to established smoking in the United States? *Am J Prev Med.* 1997;13:385–391.

55. McNeill AD, Jarvis MJ, Stapleton JA, et al. Prospective study of factors predicting uptake of smoking in adolescents. *J Epidemiol Community Health.* 1988;43:72–78.

56. Romer D, Jamieson P. Advertising, smoker imagery, and the diffusion of smoking behavior. In: Slovic P, ed. *Smoking: Risk, Perception, and Policy.* Thousand Oaks, Calif: Sage; 2001:127–155.

57. Eagly AH, Chaiken S. *The Psychology of Attitudes.* Fort Worth, Texas: Harcourt Brace Jovanovich; 1993.

58. Klitzner M, Gruenewald PJ, Bamberger E. Cigarette advertising and adolescent experimentation with smoking. *Br J Addict.* 1991;86:287–298.

59. Aitken PP, Eadie DR. Reinforcing effects of cigarette advertising on under-age smoking. *Br J Addict.* 1990;85:399–412.

60. MacFadyen L, Hastings G, MacKintosh AM. Cross sectional study of young people's awareness of and involvement with tobacco marketing. *BMJ.* 2001;322:513–517.

61. Hastings G, MacFadyen L. Smoking, branding, and the meaning of life. *Tob Control.* 1998;7:107–108.